

# USACE LOOKS BELOW THE EARTH'S SURFACE

## FOR GREEN ENERGY

*By Mr. Christopher P. Gardner*

**W**ith construction booming around Fort Drum, New York, and the Army looking for more ways to “green” its construction practices and buildings, the Fort Drum Program Office of the United States Army Corps of Engineers (USACE) New York District decided to look into alternative sustainable energy sources for new construction. One of these alternatives was geothermal energy.

### Renewable Energy Source

**T**he Corps first started using geothermal systems at Fort Drum in 2004 for the construction of the Wheeler-Sack Army Airfield Complex. These systems provide a renewable source of energy for heating and cooling buildings. The temperature below the earth’s surface remains nearly constant between 50 and 60 degrees Fahrenheit. Geothermal systems consist of a network of pipes filled with liquid buried in the ground; this acts as a heat exchanger to transfer energy to and from the building. Geothermal heat pump systems provide temperature control inside buildings without the burning of fossil fuels that occurs in traditional systems.

Use of these systems exceeds the standards for military energy requirements and reduces utility costs for Fort Drum, according to the New York District’s program

manager. In these facilities, the heating and cooling work similar to that in traditional systems. Occupants can adjust the temperature on a room-by-room basis, and the installation can adjust the temperature from a central location.

### Beyond the Barracks Projects

**D**uring the initial design of the Wheeler-Sack Army Airfield Complex in 2002, engineers from the Fort Drum Program Office met with the local Indian River School District, which incorporated a geothermal system into one of its large building additions. The engineers toured the facility and talked to the users and the design firm to get a better idea of the system operation and performance capabilities.

After learning more about the concept, visiting other facilities that used geothermal approaches, and getting a better understanding of the specifics of geothermal design, the program office was ready to incorporate it into the designs and contract language of the barracks portion of the Wheeler-Sack Army Airfield Complex being solicited. The barracks were two of 17 buildings in a \$100 million complex that was completed in 2006. The project manager at the Fort Drum Program Office reports that they were pleased with the end result of the project, and a bit surprised at how well the geothermal systems worked in the minus-20-degree

| Report Documentation Page  |                                    |                                     |   | Form Approved<br>OMB No. 0704-0188                  |                                 |
|--|------------------------------------|-------------------------------------|---|---|---------------------------------|
| Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. |                                    |                                     |   |   |                                 |
| 1. REPORT DATE<br><b>DEC 2010</b>  |                                    | 2. REPORT TYPE                      |   | 3. DATES COVERED<br><b>00-00-2010 to 00-00-2010</b> |                                 |
| 4. TITLE AND SUBTITLE<br><b>USACE Looks Below the Earth's Surface for Green Energy</b>   |                                    |                                     |   | 5a. CONTRACT NUMBER                                 |                                 |
|  |                                    |                                     |   | 5b. GRANT NUMBER                                    |                                 |
|  |                                    |                                     |   | 5c. PROGRAM ELEMENT NUMBER                          |                                 |
| 6. AUTHOR(S)   |                                    |                                     |   | 5d. PROJECT NUMBER                                  |                                 |
|  |                                    |                                     |   | 5e. TASK NUMBER                                     |                                 |
|  |                                    |                                     |   | 5f. WORK UNIT NUMBER                                |                                 |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)<br><b>Army Engineer School,Engineer Professional Bulletin,464 MANSCEN Bldg 3201 Ste 2661,Fort Leonard Wood,MO,65473</b>   |                                    |                                     |   | 8. PERFORMING ORGANIZATION REPORT NUMBER            |                                 |
| 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)  |                                    |                                     |   | 10. SPONSOR/MONITOR'S ACRONYM(S)                    |                                 |
|  |                                    |                                     |   | 11. SPONSOR/MONITOR'S REPORT NUMBER(S)              |                                 |
| 12. DISTRIBUTION/AVAILABILITY STATEMENT<br><b>Approved for public release; distribution unlimited</b>  |                                    |                                     |   |   |                                 |
| 13. SUPPLEMENTARY NOTES  |                                    |                                     |   |   |                                 |
| 14. ABSTRACT   |                                    |                                     |   |   |                                 |
| 15. SUBJECT TERMS  |                                    |                                     |   |   |                                 |
| 16. SECURITY CLASSIFICATION OF:  |                                    |                                     | 17. LIMITATION OF ABSTRACT<br><b>Same as Report (SAR)</b> | 18. NUMBER OF PAGES<br><b>3</b>                     | 19a. NAME OF RESPONSIBLE PERSON |
| a. REPORT<br><b>unclassified</b>   | b. ABSTRACT<br><b>unclassified</b> | c. THIS PAGE<br><b>unclassified</b> |   |   |                                 |





Photo by Dan Desmet, New York District public affairs

**Crews work on trenches for geothermal wells, part of the heating and cooling system at the Fort Drum, New York, child development center.**

temperatures. A survey of the residents in the Wheeler-Sack barracks yielded positive responses from all.

Based on the success with geothermal systems in barracks projects from 2004 through 2008, the Fort Drum Program Office is now providing geothermal energy as a primary option for heating and cooling needs in all new construction, where feasible. (Geothermal doesn't lend itself to large open-area buildings—such as hangars and vehicle maintenance facilities—where instead the Corps uses a green feature called “solar walls.”) Projects that support geothermal heating and cooling range from barracks facilities to administrative buildings. Although there were concerns during the design phase in 2003 that geothermal methods would not work for Fort Drum applications due to the harsh winters, the Wheeler-Sack barracks project is proof that the systems do work there.

A child development center that is now under construction incorporates a geothermal heating and cooling system. The facility is designed to be Fort Drum's first Leadership in Energy and Environmental Design (LEED) Gold building. (The LEED rating system—with its four point-system levels of Certified, Silver, Gold, and Platinum—has created a framework encompassing building



Photo by Dan Desmet, New York District public affairs

**Pipes are installed as part of geothermal wells during construction of the Fort Drum child development center.**



performance and sustainability goals.) The \$6 million child development center is essentially the Army's equivalent of a daycare center. The facility will be approximately 17,000 square feet, and contractors have drilled 16 wells to handle the facility's heating and cooling needs. The wells are approximately 425 feet deep and took about a week to drill. The depths of the geothermal wells will vary throughout the installation, depending on the geology and thermal conductivity of the area.

Using geothermal energy lowers energy costs by reducing the amount of fossil fuels burned—which can be considerable during Fort Drum's extreme winters, where temperatures can reach well below zero and have been known to reach the negative thirties. The geothermal system performs very well, even in the cold, but the project manager stressed that in the most extreme temperatures, the system sometimes needs a boost from traditional heating sources.

Despite geothermal energy's cost during the construction phase of approximately 30 percent more than traditional heating and cooling systems, the New York District's program manager pointed out that "payback"—the time it takes for a facility to recoup that initial cost with money saved in utilities—is generally three to seven years. The payback time depends on the building size and the fluctuating cost of fossil fuels—the latter having shortened the estimated payback time in recent years. The program office is looking into monitoring systems to determine the specific return on investment of geothermal energy at Fort Drum.

### Energy Progress at Fort Drum

**G**eothermal energy has been used, where feasible, during the construction of facilities since 2004. As of today, geothermal systems have been incorporated into 19 buildings currently completed, under construction, or under design at Fort Drum. This includes the aforementioned child development center, 11 barracks buildings, a brigade and a battalion headquarters building, and the addition to the Guthrie Ambulatory Health Care Clinic. Geothermal energy was also used in the recently completed Warrior in Transition Complex constructed for injured Soldiers (see article on page 40) and will be included in the next two facilities to be added to this complex.



*Mr. Gardner is a public affairs specialist with the United States Army Corps of Engineers. He currently serves with the New York District, based in New York City. He holds a bachelor's in mass communication from the University of South Florida in Tampa.*

